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EDITORIAL.

Tapioca Experiments.

The cultivation of tapioca is associated in the minds of many people with exhaustion of the soil and soil erosion. It stands to reason that under the old system of cultivation, such objections were largely justified. The removal of successive crops to an aggregate of perhaps 20 tons without manuring was bound to result in seriously reduced fertility. Probably even greater loss resulted from the failure to take precautions to prevent erosion, which in a tropical country subject to frequent torrential rain, and with a crop harvested by digging, could be very rapid.

Restrictive measures on the cultivation of this crop were therefore taken by the Governments in Malaya. In some instances the cultivation of tapioca was prohibited. The result of investigations by the Department of Agriculture has clarified the position and in recent years any restrictive measures have been based on the results of these experiments.

The enquiry into this subject is brought up to date by the inclusion in this number of an article on "The Economic Maintenance of Soil Fertility under Continuous Cropping with Tapioca". The author introduces his subject by a reference to previous investigations, followed by a consideration of the cultivation of tapioca as a catch crop and as a sole crop.

Cultivation as a catch crop is limited by the fact that there is no land being newly-opened with rubber, while its cultivation with oil palms is less remunerative. Consequently, consideration is given to the possibility of growing tapioca as a sole crop, with suitable provisions to maintain fertility and to obviate soil erosion.

On Raub high-level soil all treatments were profitable, but on a valley quartzite soil none of the systems of manuring proved remunerative.

A further experiment of growing tapioca in rotation with other crops is in progress, but has not continued sufficiently long for definite results to be obtained. While it is possible that soil fertility has been maintained by this system the crops have not been profitable.

It should be remembered that these recent trials were conducted on two particular types of soil, and the results, therefore, are indicative of the effect

of tapioca only on these two soils. These two types of soil occur, however, in many parts of the country and are similar to the soils on which tapioca was widely planted in the past.

Agricultural Trade in Malaya. With the improvement of statistical information in recent years, it is now possible—and profitable—periodically to review the position of Malayan agriculture from a detached point of view and thus to study the progress of agricultural trade by comparison with previous years.

The annual official publications of foreign imports, exports and shipping form the basis of an article on Malayan agricultural trade in 1936 which is published in this number. The author takes into consideration all the crops grown in Malaya and the import of all agricultural products which it is possible, though perhaps not economical, to grow in this country.

Malayan agricultural trade may be divided into four classes:—crops grown for local consumption, crops grown for export, import products and the entrepôt trade. The main fact which emerges from this enquiry is that despite the steady expansion of local production, both for consumption in Malaya and for export, imports by far exceed exports. This would be of little moment if import products were mainly of the luxury class. Unfortunately, however, this is not the case; 60 per cent. of the rice required for local consumption is imported, Malaya is the second largest importer in the world of milk, while many other essential food products are imported in large quantities.

The export trade has been hampered during the past few years by the serious trade depression and by schemes of restriction—either of planting, production or export. Rising prices have eased the situation during the year under review so that while prosperity has increased the demand and consequent import of products for local consumption, yet the value of exports exceeds that of imports by an increasing amount, and now stands at a figure which has not been surpassed since the year 1929.

It appears, therefore, that we may congratulate ourselves on a favourable trade balance, so far as values are concerned. The position regarding essential foodstuffs, however, has changed very little during the past five years, and we are left with an uneasy feeling when we realize our continued dependence on other countries for at least half of our food requirements.

Original Articles.

EXPERIMENTS ON THE ECONOMIC MAINTENANCE OF SOIL FERTILITY UNDER CONTINUOUS CROPPING WITH TAPIOCA

BY

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Introductory.

Preliminary investigations into the problem of soil fertility in connexion with the cultivation of tapioca were commenced in 1925 when chemical analyses of both the plant and soils were undertaken. As a result of these investigations a ruling was made allowing not more than two crops of tapioca to be taken from land alienated for the cultivation of rubber (*Hevea braziliensis*), *F.M.S. Goverment Gazette Notification* No. 1964, dated 1st April, 1927. (2)

Tapioca has the reputation of being an exhaustive crop; this was earned in the early days of its cultivation when little attention was paid either to soil conservation or to manuring.

Tapioca as a Catch Crop.

For some years a large proportion of the tapioca products exported from Malaya has been produced as a catch crop with rubber, but owing to the International Rubber Restriction Agreement there is now little opportunity for this form of cultivation.

Experiments carried out at the Central Experiment Station, Serdang (1 & 2) indicate that the cultivation of tapioca as a catch-crop with oil palms is not as practicable as with rubber (*Hevea*) owing to the spreading nature of the palm leaves. It should be possible to obtain one fairly good crop of tapioca and perhaps a second, covering a considerably smaller area, before the palms are large enough to preclude its cultivation. Whether this form of cultivation would be profitable would, of course, depend upon the price of tapioca and facilities available for the disposal of the crop.

Since the cultivation of tapioca as a catch crop either with rubber or oil palms is limited under present conditions it becomes desirable to find some other economic method of growing this important crop. With this object in view experiments have been in progress for some years at the Central Experiment Station, Serdang, and this article gives the results of investigations made up to the end of the year 1936.

Tapioca as a Sole Crop.

SUMMARY OF PREVIOUS INVESTIGATIONS.

The cultivation of tapioca as a sole crop with the aid of manures was commenced at the Central Experiment Station, Serdang, in November, 1924, when an area of ten acres was planted. The first crop planted was treated as a preliminary trial and at harvest was divided into half-acre plots. These plots were subsequently treated in different ways and two further crops of tapioca were grown. There were five treatments in duplicate and ten control plots. The results of this work have been published (2) and may be summarized as follows:—

The ten acres planted with tapioca in November, 1924, had been recently opened from light jungle and were situated on flat land, the soil being of the valley quartzite type which is described as a dark clay loam having 50 to 60 per cent. fine fractions.

(i) Horse gram (*Dolichos biflorus*) dug into the soil after four months' growth failed to produce any increase in the crop of tapioca.

(ii) Horse gram—grown on plots that were limed at the rate of 1 ton per acre—and subsequently dug into the soil, increased the next crop of tapioca, but had no beneficial effect upon the third crop.

(iii) An artificial farmyard manure made from *lallang* grass and ADCO* was applied to the second crop, at the rate of 8 tons per acre. Farmyard manure at the rate of 22 tons per acre was also applied for the third crop. The effect of the ADCO manure applied to the second crop was uncertain, but the cattle manure produced a definite increase in yield for the third crop.

(iv) A complete mixture of fertilizers containing nitrogen, phosphoric acid and potash equivalent to that supplied in the farmyard manures was applied to both the second and third crops. This treatment produced a marked increase in the yield of the second crop, but no further increase in the third crop. There was little difference between the yields from the cattle manure and fertilizer plots.

(v) The average yields from the control plots were:—

1st crop 6.31 tons of roots per acre.
2nd ,, 7.77 ,, ,,
3rd ,, 6.20 ,, ,,

These figures show that yields from the untreated plots were as heavy for the third as for the first crop. A good crop for this particular variety in good soil would be about 8 to 9 tons of fresh root per acre.

The experiment was abandoned after the third crop had been harvested owing to its unwieldy size and unsound lay-out for the statistical analysis of results. Therefore, conclusive results on the economic maintenance of soil fertility or the exhaustive effect of continuous cultivation of tapioca under different methods of husbandry were not proved beyond the third crop.

* A mixture of chemicals patented under the name of ADCO claimed to possess the property of causing straw and waste material to rot rapidly and form a substitute for farmyard manure. (4).

The experiment indicates that it is possible to maintain yields with heavy dressings of farmyard manure or chemical fertilizers, but owing to the low price of tapioca, and the low-yielding variety used in the experiment the treatments were too costly to be economical.

RECENT INVESTIGATIONS.

During November, 1932, a further experiment with the same objects in view was commenced on 1 acre blocks on two different kinds of soil. One of the areas selected for this experiment is in Block 30 where the soil is of the valley quartzite type and a dark clay loam. The second area is in Block 40 on undulating land on the high-level Raub series of laterite soils and is reddish-yellow clay loam with a distinct crumb structure and easily worked.

History of the Blocks.

The 1 acre on the valley quartzite soil selected for this experiment consists of two half-acre plots which were used as controls in the previous experiments. These plots had produced three crops of tapioca roots of about 6 tons each without manure.

The area on the high-level Raub series of soils was opened from jungle in 1926, and was laid down with carpet grass, *Axonopus compressus*, as a grazing paddock for cattle. This area was under grass until the experiment was commenced in November, 1932. The 1 acre block on the valley quartzite soil is quite level, but that on the Raub series is gently sloping. Silt-pits were therefore dug and bunds constructed round each plot to prevent the movement of soil and plant nutrients from one plot to another.

Lay-out of the Experiment.

The lay-out of the experiment took the form of a four-way Latin Square in each acre block, each plot being 1/16th acre. The treatments were as follows:—

(*a*) Cattle manure at the rate of 10 tons per acre.

(*b*) Artificial manures, NPK., as follows:—

Calcium cyanamide	...	1 cwt. per acre.
Basic slag	...	2 ,, ,,
Sulphate of potash	...	½ ,, ,,

(*c*) Green manure (cuttings of Crotalaria) at the rate of 2 tons per acre, plus basic slag, 1 cwt. per acre.

(*d*) Untreated control.

The manures and green material were dug into the plots before planting.

The variety of tapioca cultivated for the first two crops was Native No. 1 (Singapore Red). As this variety is palatable and therefore subject to theft and damage by rats and monkeys, for the third and fourth crops the less palatable variety "Manteiga" was planted.

Tapioca has been grown continuously on the plots in this experiment. The crop is allowed to grow for twelve months from the time of planting the cuttings, and as soon as one crop is harvested the land is prepared and replanted. All the plots

are treated alike as regards cultivation; they are all dug over to a depth of 7 or 8 inches and, on those plots that receive dressings of manure or green matter, this is dug in at the same time.

Discussion of Results.

In Table I will be found the mean yields per plot over the four years, 1933-1936, together with the differences necessary to be significant. These figures are calculated by analysis of variance and Fisher's "t" test using P = 0.5 for differences between treatments and P = 0.1 for differences between treatments and controls.

The figures in Tables I and II show that for the 1933 crop NPK has given the highest yields in Block 30, while farmyard manure has given the best yields in Block 40. In Block 30, however, none of the differences in yield are significant, while in Block 40 all treatments were significantly better than the controls, but there is no significant difference between the different treatments.

The 1934 crops were lower than those for 1933 in both blocks, and all treatments were significantly better than the controls. Farmyard manure gave the best yields in both cases and they are significantly better than the other two treatments. The differences between the yields from NPK plots and those to which basic slag and a green dressing was applied are small and not significant.

In 1935, the yields were greatly increased due to the fact that an inherently better-yielding variety was used. In this case the Block 30 yields show that farmyard manure plots gave significantly better yields than any of the other treatments or the control, but the differences between the other treatments and the control are not significant. In Block 40, however, all treatments are significantly better than the controls, and farmyard manure is better than the other treatments. There is no significant difference, however, between the yields from the other two treatments.

The crops in 1936 were smaller than in 1935, but larger than in 1934. In both blocks cattle manure produced significantly better yields than the other treatments or the controls. NPK treatment is better than the control in both cases. The yields from the NPK plots in Block 30 are better than from the basic slag and green manure plots, but there is no significant difference between yields from these two treatments in Block 40.

The use of the variety Aipin Manteiga for the last two crops has interfered with the sequence of reduction in yields, which might be inferred by comparison of the first and second year's results. On the other hand, the change demonstrates the advantage to be derived from the cultivation of a high-yielding variety. The 1936 yields are lower than those of 1935 partly owing to the fact that there were more vacancies due to unsuitable weather after planting, but the yields per plot for 1936 are still lower than in 1935 even when the average weights of roots for 1936 are multiplied by the number of plants harvested in 1935. The effect of treatments calculated as percentages of the general mean are of the same order as the actual yield. These results indicate that an increase in the quantities of

Table I.

The Means of Yields of Tapioca Root per Plot from four Crops, 1933 to 1936.

Treatments.	Mean Yields 1933		Mean Yields 1934		Mean Yields 1935		Mean Yields 1936	
	Block 30	Block 40	Block 30	Block 40	Block 30	Block 40	Block 30	Block 40
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
FYM = A ...	635	1,133	705	924	1,328	2,340	1,004	1,435
NPK = B ...	712	1,043	556	705	932	1,822	741	1,056
Basic slag and Crotalaria = C ...	634	1,049	529	725	866	1,723	617	863
Control = D ...	575	789	397	465	907	1,135	621	771
General Means ...	639	1,003	547	704	1,008	1,755	745	1,031
S.D. ...	145.05	105.96	72.81	59.38	160.06	159.11	33.38	114.52
	Differences Required for Significance.							
Differences between	1933		1934		1935		1936	
	Block 30	Block 40	Block 30	Block 40	Block 30	Block 40	Block 30	Block 40
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Treatments ...	251	183	126	100	277	275	91	201
Treatments & controls	199	146	100	90	220	219	72	159

Table II.

Calculated Yields of Tapioca Root per acre for four Crops, 1933-1936.

Treatments.	Yields per acre 1933		Yields per acre 1934		Yields per acre 1935		Yields per acre 1936	
	lbs.	piculs.	lbs.	piculs.	lbs.	piculs.	lbs.	piculs.
		Block 30 Valley Quartzite Soil.						
A ...	10,164	76.23	11,276	84.57	21,244	159.33	16,064	120.23
B ...	11,392	85.44	8,892	66.69	14,912	111.84	11,856	88.92
C ...	10,136	76.02	8,456	63.69	13,848	103.86	9,872	74.04
D ...	9,192	68.94	6,356	47.67	14,504	108.78	9,936	74.52
		Block 40 — Raub High-Level Soil.						
A ...	18,132	135.99	14,776	110.82	37,432	280.74	22,960	172.20
B ...	16,680	125.10	11,274	84.55	29,152	218.64	16,896	126.72
C ...	16,784	125.88	11,596	86.97	27,564	206.73	13,808	101.06
D ...	12,616	94.62	7,476	56.07	18,156	136.17	12,336	92.52

1 picul = 133.33 lbs.

Table III.

Increases in Yield of Tapioca Roots due to Treatment.

(in piculs per acre.)

Treatments.	1933	1934	1935	1936	Total	Means.
		Block 30 Valley Quartzite Soil.				
A. Cattle manure ...	7.29	36.90	50.55	45.71	140.45	35.11
B. NPK ...	16.50	19.02	3.06	14.40	52.98	13.25
C. Basic slag, plus Crotalaria ...	7.08	15.75	— 4.92	— 0.48	17.42	4.36
		Block 40 Raub High-Level Soil.				
A. Cattle manure ...	41.37	54.75	144.57	79.68	320.37	80.09
B. NPK ...	30.48	28.48	82.47	34.20	175.63	43.41
C. Basic slag, plus Crotalaria ...	31.26	30.90	70.56	8.44	141.16	35.29

1 picul = 133.33 lbs.

Table IV.

The Value of Increases in Yield Calculated at 50 cents per picul of Roots.

Treatments.	1933	1934	1935	1936	Total	Means	Cost of Manures.	Profit or Loss.
	$	$	$	$	$	$	$	$
			Block 30 Valley Quartzite Soil.					
A. Cattle manure ...	3.64	18.45	25,28	22.86	70.23	17.56	25.00	— 7.44
B. NPK ...	8.25	9.51	1.53	7.20	26.49	6.62	13.00	— 6.38
C. Basic slag, plus Crotalaria. ...	3.54	7.87	— 2.46	0.24	8.71	2.18	5.00	— 2.82
			Block 40 Raub High-Level Soil.					
A. Cattle manure ...	20.68	27.37	72.28	39.84	160.19	40.05	25.00	+15.05
B. NPK ...	15.24	14.24	41.23	17.10	87.82	21.96	13.00	+ 8.96
C. Basic slag, plus Crotalaria. ...	15.63	15.45	35.28	4.22	70.58	17.65	5.00	+12.65

$1 = 2s. 4d.

manure may be necessary to maintain fertility with the heavier-yielding variety, but it is still too early to state definitely whether this is the case.

The Economics of Manuring.

In Table III will be found the mean increases in yields over the control plots, in piculs of roots per acre, and in Table IV the values of these increases calculated at 50 cents per picul.

The extra costs of treatments per acre over the controls are as follows:—

a.	Cattle manure @ \$2.50 per ton =	\$25
b.	NPK including freight, mixing, and spreading, say	13
c.	Basic slag, \$2.25, plus cost of collecting and spreading Crotalaria cuttings, say \$2.75 =	5

From these figures it will be seen that in Block 30 (valley quartzite soil) none of the treatments have produced sufficient increase in yield to cover the extra cost. On the other hand, in Block 40 (high-level Raub soil) there has been a profit from all treatments.

Summary.

1. Preliminary work in connexion with the maintenance of fertility in the soil under continuous cropping with tapioca is described.

2. Results of a continuation of this work on a smaller scale, but with plots laid out on statistically sound lines are given for four years, 1933 to 1936.

3. It is shown that Raub high-level soil has up to the present produced higher yields than valley quartzite.

4. Farmyard manure has given better results than either a complete mixture of chemical manures or a green manure (*Crotalaria* sp.) dug into the soil and supplemented with basic slag.

5. All treatments on the Raub high-level soil gave significant increase over the control, but, with the exception of the 1934 crop, this was not the case on the valley quartzite soil.

6. The yield figures show that the second crop of tapioca was smaller than the first crop, but that the third crop was considerably higher owing to the use of an inherently high-yielding variety of tapioca. The fourth crop was smaller than the third crop, but it is too early to say anything definite with regard to this particular result.

7. On the valley quartzite soil the manures have not increased the crop sufficiently to pay for the cost of dressings, whereas on the Raub high-level soil all treatments have been profitable.

Crop Rotation with Tapioca Experiments.

A further experiment is in progress, the object of which is to ascertain whether it is possible to grow tapioca economically in rotation with other short duration crops. The rotation is a simple one in which tapioca occupies the land for a year, and during the following six months a crop of maize or cow pea is grown, followed again by tapioca. With this rotation, a crop of tapioca is taken from the land every eighteen months and also an additional crop which will provide a small amount in revenue, together with organic matter for turning into the soil for the next tapioca crop.

The area under this experiment comprises 2 acres situated on flat land. The soil is of the valley quartzite type and may be described as a sandy clay loam. This area which was cleared of light jungle in 1924, has been under cultivation with various crops, including sugar-cane, tuba root (*Derris* sp.) and tapioca. The last crop was removed in November, 1932, after which weeds were allowed to grow until May, 1933, when the Rotation Experiment was commenced. Cattle manure at the rate of 10 tons per acre was turned into the soil, together with weeds. The area was divided into six plots of 1/3rd acre each, three of which were given a dressing of lime at the rate of 10 cwts. per acre and to three basic slag at the rate of 2 cwts. per acre. The first crop planted was maize in rows 3 feet apart and between the rows *Crotalaria anagyroides* to provide green material for turning into the soil.

The average yields of cleaned maize were 632 lbs. per acre from the limed plots and 489 lbs. per acre from the plots to which basic slag had been applied. These yields indicate that the soil was of poor fertility at the commencement of the experiment for, from good soil, as much as 2,000 lbs. of cleaned maize per acre have been obtained at Serdang.

The first tapioca crop was planted in October, 1933, when three varieties, Manteiga, Singapore and M.S.P.P. No. 1964, were planted on each plot. Three varieties were used because there was insufficient planting material available of any one variety. The crop was lifted in November, 1934, and yielded 24,613 lbs. on the limed plots and 23,715 lbs. of fresh root per acre on the basic slag plots. This can be considered a good yield, for a fair average crop is approximately 150 piculs or 19,950 lbs. of fresh root per acre.

Table V.

Yields of Fresh Root per acre for the Different Varieties of Tapioca.

Variety.	Lime	Basic slag.	Total	Means.
	lbs.	lbs.	lbs.	lbs.
Manteiga ...	23,952	22,065	46,017	23,008
M.S.P.P. 1964 ...	36,729	36,672	73,401	36,700
Singapore ...	13,158	12,408	25,566	12,783
Totals ...	73,839	71,145	144,984	—
Means ...	24,613	23,715	—	24,364 General Mean.

The next crop grown was cow pea (*Vigna catjang*) as fodder for stock. This was sown in December, 1934, two varieties of cow pea being used for the purpose, *viz.* Red and White, half of each plot being planted with each variety. The red variety was mown with a scythe after it had occupied the land for approximately 56 days. The white variety occupied the land 83 days. The yields of green fodder were 2,032 lbs. per acre from the red variety and 5,007 lbs. per acre from the white variety. This material was all fed to cattle; the residue together with weeds was turned into the soil when preparing for the second crop of tapioca, which was planted on the 1st April, 1935.

Table VI.

Yields per acre of Cow Pea Vine.

Variety.	Lime	Basic slag.	Total	Means.
	lbs.	lbs.	lbs.	lbs.
Red ...	1,069	963	2,032	1,016
White ...	2,682	2,325	5,007	2,503
Totals ...	3,751	3,288	7,039	—
Means ...	1,875	1,644	—	1,760 General Mean.

Before planting the second crop of tapioca the lime plots received a dressing of 10 cwts. of lime per acre and the basic slag plots 2 cwts. per acre of basic slag.

The variety of tapioca planted was Native No. 1 (Singapore Red), being the only variety available at the time from which sufficient cuttings could be obtained. This variety is a poor yielder compared with Manteiga and M.S.P.P. 1964 and in consequence the second crop of tapioca harvested in April, 1936, was comparatively poor, the yields being 12,778 lbs. per acre from the limed plots and 9,922 lbs. per acre from the basic slag plots.

Before it can be definitely stated that there is a falling off in fertility, further crops of high-yielding varieties must be grown.

Subsequently, a crop of maize was grown with *Crotalaria usaramoensis* intersown to provide leguminous green material for digging into the soil during October or November, 1936. A complete mixture of fertilizer consisting of calcium cyanamide 1 cwt., basic slag 2 cwts., and sulphate of potash ½ cwt. per acre, was applied to the whole area before the maize was sown.

The maize crop was harvested in September, 1936, and produced 872 lbs. of cleaned maize per acre from the limed plot and 547 lbs. per acre from the basic slag plot. This indicates that the fertility of the soil has not decreased, for the first crops of cleaned maize (in 1933) were only 632 and 489 lbs. respectively. The same variety of maize, namely Native Yellow Flint, was used in both cases. Manteiga tapioca was again planted in October and the growth of the crop at present (January, 1937) appears to be excellent.

From the economic point of view this rotation has not been a financial success. The calculated expenditure and income up to the harvest of the main crop (September, 1936) are given in the following table. It must of course be borne in mind that the expenditure could be reduced if this rotation were carried out on a commercial basis for costs include very careful planting, harvesting and weighing the produce from small plots. The income in the following table has been calculated as follows:—maize @ $4.25 per picul; tapioca @ 50 cents per picul of roots, and cow pea @ 50 cents per picul of green material.

Crop.	Income per acre.		Expenditure per acre.
	Lime Plots.	Basic Slag Plots.	
	$	$	$
1st maize crop ...	20.15	15.60	71.11
1st tapioca crop ...	92.37	88.92	58.29
Cow pea crop ...	14.07	12.33	27.16
2nd tapioca crop ...	47.92	37.21	68.66
2nd maize crop ...	27.80	17.43	63.30
Total ...	202.31	171.49	288.52

Tapioca Cultivation in Conjunction with Pig Keeping.

Although the tapioca rotation experiment has not been carried far enough to give definite results it is possible that such a method of cropping would prove profitable if carried out in conjunction with the rearing of pigs. A large proportion of the food requirements could be grown on the land and the manure obtained would help to keep the soil in a fertile condition.

To make such a proposition successful it would be necessary to divide the land into plots so that tapioca could be planted every six months to ensure a continuous supply of fresh roots, and provide plots for growing other fodder crops in rotation.

Mr. T. D. Marsh estimates that a crop of ten tons or 168 piculs of tapioca roots, together with other food-stuffs would be sufficient to feed a mixed herd of 53 pigs (mature and fattening) for one month, allowing 14 lbs. of tapioca roots per head per day.

The manure from such a herd, calculated on figures obtained at Serdang, would average between 170 and 200 lbs. per day; add to this litter at 10 lbs. per animal—530 lbs., and urine absorbed by the litter 200 lbs., the fresh manure produced daily would be about 900 lbs. Allowing for a loss of 66 per cent. in the process of rotting, 306 lbs. of manure per day could be produced, which is equivalent to 4 tons per month.

To feed 53 pigs 18 to 20 acres of land would be required *i.e.* 6 acres planted with tapioca every six months and 6 to 8 acres with other fodder crops in rotation. Each acre could receive 6 tons of farmyard manure every eighteen months applied to the shorter duration crops. This, with the addition of any green material available for turning into the land, and a small dressing of artificials, would possibly maintain soil fertility.

Summary.

1. A crop rotation experiment with tapioca is described and progress since the commencement in May, 1933, is given. The experiment has not been in progress long enough to obtain definite results.

2. There are indications that soil fertility has been maintained, but from an economic point of view the resulting crops have not been profitable under conditions obtaining at the Central Experiment Station, Serdang.

3. It is possible that a rotation of crops on similar lines to that described may be profitable if carried out in conjunction with the rearing of pigs.

Acknowledgments.

Mr. W. N. C. Belgrave, Chief Research Officer, was responsible for initiation of the lay-out of the second experiment and Mr. T. D. Marsh for supervising the harvesting and reporting on the 1934 crops and the planting of the 1935 crops.

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MALAYAN AGRICULTURAL TRADE IN 1936

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Malayan agriculture may be considered under three categories; the production of crops for internal consumption, agricultural products for export, and the preparation for market of products from neighbouring countries. In order to review Malayan agriculture as a whole, consideration must also be given to the import of products which—at least theoretically although perhaps not economically—might be grown in this country. From an examination of the volume and value of trade under these heads in 1936, a survey may be made of the position of agriculture for the year under review and contrasted with previous years.

Local Agricultural Produce.

The chief crops grown for local consumption are rice, coconuts, vegetables, fruit, coffee and tea, besides a number of minor crops.

Rice ranks first of crops grown for local consumption, and it is the only crop of this nature about which reasonably accurate statistics are available. The total crop harvested in 1936 was 325,500 tons, constituting a record. It is significant of the improvement of the rice-growing industry that although the total area cultivated is only 2.4 per cent. greater than five years ago, the crop is up by 30 per cent. The vigorous policy of the Government is mainly responsible for this striking improvement.

There is always some difficulty in maintaining the area under rice in competition with more remunerative crops, and the attraction of rubber and coconuts on a rising market is already felt. Should the recent improvement in prices of these two products continue, one may anticipate some difficulty in maintaining the present area under rice. It should be added, however, that the less productive areas are the first to be neglected, so that, although the area may tend to decrease, the total crop should not be materially affected.

The improved trade conditions and the increase in immigration resulted in an increased consumption of rice, imports being up by 58,000 tons. Nevertheless, the percentage of production to consumption was 38 as compared to an average of 40 per cent. for the previous four years.

The value of the local rice produced—based on the import value of Rangoon rice—was about $19,700,000, as compared with $19,000,000 in 1935 and $16,000,000 in 1934. The value of coconuts grown in Malaya for local consumption is computed to be about $4,000,000. In the absence of adequate statistical data, it is impossible to compute the value of the local production of fruits and vegetables. Such additional information as is forthcoming, however,

confirms the estimate made a year ago* that Malaya has reached a position where it produces at least 50 per cent. of its food requirements.

Export Crops.

The principal export crops are rubber, coconut products, pineapples, oil palm products and arecanuts. Other crops grown for export are tapioca, sago, gambier and tuba root (derris), and to a relatively small extent spices and patchouli.

Rubber.—The average Singapore market price of rubber in 1936 was 27.04 cents per lb., as compared with 20.25 cents for the previous year. The control of production and exports exercised under the International Rubber Regulation Scheme was responsible for a further decrease in net exports which amounted to 352,343 tons as compared with 415,667 tons in 1935 or 15 per cent. less exports in 1936. The improved price of the product, however, more than counterbalanced this decline in production, in consequence of which the declared value of net exports in 1936 was $208,500,000 or 8 per cent. greater than in 1935.

Coconut Products.—Market prices for all coconut products appreciated considerably during 1936 as is shewn by the following increases of average market prices per picul in Singapore: copra $4.54 in 1935 to $5.81 in 1936, coconut oil $9.13 to $11.96, coconut cake $1.55 to $1.67. In consequence, the value of net exports was up by over 1½ million dollars. The actual production apparently was less than the record figure recorded for the previous year by 18,000 tons of copra—due possibly to seasonal fluctuations.

The most notable feature of the coconut products market is the continued growth of the production and export of coconut oil. Coconut oil net exports were 46,507 tons, an increase of 30 per cent. over the previous year's figure and 447 per cent. greater than the average annual production before 1932.

The increased production of coconut oil has led to a corresponding growth in the export of coconut cake which in 1936 amounted to over 20,000 tons as compared with 16,000 tons in 1935.

In addition, the export of fresh coconuts was fully maintained during 1936 at 8,000 tons.

Pineapples.—Shipments of canned pineapples in 1936 shewed an increase of 3½ per cent. as compared with shipments in 1935. The continued growth of this trade is largely due to the transition of cultivation from a catch crop basis to that of a sole crop. This, coupled with improvements in canning, has enabled the product to maintain its popularity in the world market in the face of growing competition.

Oil Palm Products.—The oil palm industry now constitutes the fourth export crop in order of importance. The average market price of palm oil was about the same as that recorded in 1935, but kernels appreciated by 27 per cent. Crops continue to increase—due to new areas coming into bearing and other areas approaching maximum productivity, so that the export of kernels (4,964 tons)

* Malayan Agricultural Trade in 1935. *Malayan Agricultural Journal* Vol. XXIV No. 4, p. 181.

was 27 per cent. greater than in 1935, while net exports of oil (29,296 tons) were 19 per cent. greater than the previous year. With the present planted area of oil palms, production is likely to reach its peak at about 50,000 tons of palm oil within the next five years.

Arecanuts.—The market price of arecanuts shewed a slight decline in 1936, in spite of which the volume of trade increased and local production improved as is shewn by the increase in exports of 16 per cent.

The remainder of the export crops call for little comment: tapioca exports declined by 1,000 tons to 17,000 tons, sago exports decreased from 7,841 tons in 1935 to 2,015 tons in 1936, and the exports of gambier products shewed further shrinkage. Derris (tuba root), although still a minor industry, increased by a few tons. Patchouli oil production, both from locally grown leaves and imported leaves, is a minor industry which has revived in the past year. Details of the trade in all the above crops are given in Table I.

Table I.

Imports and Exports of certain Agricultural Products 1936.

Product	Imports		Exports		Net Exports	
	Tons	Value $	Tons	Value $	Tons	Value $
Rubber ...	167,799	94,833,786	520,142	303,314,838	352,343	208,481,052
Coconut Products ...	120,502	10,987,007	272,293	27,810,317	151,791	16,823,310
Pineapples ...	2	464	76,405	8,686,549	76,403	8,686,085
Oil Palm Products ...	141	23,207	34,401	4,317,316	34,260	4,294,109
Arecanuts ...	45,181	4,290,090	71,729	7,527,461	26,548	3,237,371
Tapioca ...	6,647	548,323	23,561	1,939,438	16,914	1,391,115
Sago ...	72,377	2,932,561	74,392	3,937,445	2,015	1,004,884
Gambier ...	1,955	275,494	4,143	728,878	2,188	453,384
Derris ...	88	38,389	687	527,023	599	488,634

To summarize, net exports of agricultural products other than rubber shewed a decline of 1 per cent. in quantity and 8 per cent. in value in comparison with the year 1935. Adding net exports of rubber, the figures become:

1935 730,127 tons valued at $231,176,882
1936 663,701 ,, ,, $245,218,982

Table II.

Annual Net Imports and Exports of Agricultural Products, Malaya.

Year	Net Imports*		Net Exports† (excluding rubber)		Excess of Imports over Exports (excluding rubber)		Net Exports of Rubber		Excess of Total Imports over Exports	Excess Value of Exports over Value of Imports
	Quantity Tons	Value $	Quantity Tons	Value $	Quantity Tons	Value $	Quantity Tons	Value $	Quantity Tons	Value $
1	2	3	4	5	6	7	8	9	10	11
1923	643,000	101,600,000	206,600	43,100,000	436,400	58,500,000	181,700	227,200,000	254,700	168,700,000
1924	694,600	118,400,000	219,000	51,600,000	475,600	66,800,000	152,500	189,900,000	323,100	123,100,000
1925	744,800	133,100,000	218,700	48,600,000	526,100	84,500,000	161,800	519,000,000	364,300	434,500,000
1926	857,300	157,400,000	225,800	50,000,000	631,500	107,400,000	243,400	547,500,000	388,100	440,100,000
1927	956,000	167,400,000	207,500	42,700,000	748,500	124,700,000	190,700	351,400,000	557,800	226,700,000
1928	921,400	158,900,000	230,700	44,900,000	690,700	114,000,000	260,100	262,900,000	430,600	148,900,000
1929	1,004,500	171,700,000	254,700	44,000,000	749,800	127,700,000	418,000	353,700,000	331,800	226,000,000
1930	1,022,300	150,800,000	244,100	37,800,000	778,200	113,000,000	421,000	199,600,000	357,200	86,600,000
1931	883,200	92,100,000	241,200	26,700,000	642,000	65,400,000	393,600	99,300,000	248,400	33,900,000
1932	737,800	74,200,000	253,500	29,000,000	484,300	45,200,000	386,000	68,100,000	98,300	22,900,000
1933	770,000	66,700,000	265,700	25,600,000	504,300	41,100,000	445,700	101,400,000	58,600	60,300,000
1934	871,200	78,700,000	272,800	23,400,000	598,400	55,300,000	465,800	207,900,000	132,600	152,600,000
1935	885,100	81,100,000	314,500	40,000,000	750,600	41,100,000	415,700	191,100,000	154,900	150,000,000
1936	991,900	87,100,000	311,400	36,700,000	680,500	50,400,000	352,300	208,500,000	328,200	158,100,000

* Imports include coir cordage and fibre, mats and matting, padi and rice, coffee, tea, kapok, mace and nutmegs, pepper, ginger, groundnuts and groundnut oil, sugar, tobacco, vegetables, livestock for food, meat, leather goods, milk, butter, poultry and eggs, feeding stuffs for animals, ataps, cloves, castor oil, gingelly seed and oil, fruits, and tapioca refuse.

† Exports include rubber seed, coconut products, palm oil and kernels, canned pineapples, arecanuts, sago, tapioca, derris root, hides and skins, gambier, patchouli leaves and oil, mace and nutmegs.

Import Products.

At the foot of Table II is enumerated a number of products which Malaya imports for local consumption. The most important of these were rice—the net imports of which were 670,731 tons, valued at $35,956,000, tobacco valued at $13,398,000, milk $6,990,000, sugar 112,577 tons, valued at $6,731,000, vegetables $4,204,000, fruits $3,510,000, groundnuts and groundnut oil $3,153,000, livestock and meat $4,162,000. The imports of rice overshadow the remainder on this list of imports in the same way as rubber overshadows all the rest of the exports of agricultural products.

The total net imports were 991,870 tons and shew an increase of 12 per cent. in quantity and of 8 per cent. in value in comparison with 1935.

Entrepôt Trade.

The large entrepôt trade is centred on Singapore and Penang, at which ports there is not only a vast transhipping trade, but a trade in the preparation and treatment for world markets of the agricultural produce of Malaya and of neighbouring countries. The only way of assessing the extent and value of these trades is by consideration of the gross imports and exports. The gross agricultural trade of Malaya (imports plus exports) in 1936 was 2,998,000 tons, valued at $609,000,000, as compared with 2,958,000 tons, valued at $533,000,000 in 1935; an index of returning prosperity for agriculture. Present indications are that these figures will be improved upon in the year 1937.

Particulars of the most important of these industries are given in Table I. In comparison with the year before it is noted that the shipments of coconut products, to and from Malaya have increased, while sago—now such a minor producing industry—has increased in importance as a manufacturing industry, imports having increased by 17 per cent. and exports by 7 per cent. over the 1935 figures.

The Value of Agricultural Trade.

The actual value to the country of its agricultural trade may be estimated by consideration of the balance of net exports over net imports. Table II reviews the position annually since the year 1923. From this data a balance is struck of the volume and value to Malaya of the year's trading. In 1936, the net imports amounted to 991,900 tons valued at $87,000,000. Net exports (excluding rubber) were 311,400 tons, valued at $37,000,000. Malayan agricultural trade, of crops other than rubber and rice, shews an excess of imports over exports of 5,000 tons, and the value of these imports exceeded the value of the exports by $14,227,000. In 1935, exports exceeded imports by 39,400 tons, but the imports exceeded the value of exports by $8,253,000. In 1934, again excluding rubber and rice, imports exceeded exports by 11,000 tons, and in value by $28,000,000.

While these figures imply a more unfavourable trade balance in 1936, they actually reflect the increasing spending power of the country which is to be anticipated from the considerable increase in the excess value of exports over imports when rubber exports are included, as shewn in the next paragraph.

To include all imports and exports of agricultural products, however, gives a more complete picture of the agricultural trade. This shews that imports have exceeded exports by 328,000 tons, as compared with 155,000 tons in 1935, but that the value of agricultural exports exceeded imports by $158,000,000 or $8,000,000 more than in the previous year.

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THE NITROGEN-POTASH RATIO OF OIL PALM LEAFLETS

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Introductory.

An enquiry was received from an estate in Johore regarding the possibility of anticipating the manurial requirements of the oil palm, more particularly in respect of potash, by determining the nitrogen-potash ratio of the leaflets.

Work on these lines has already been carried out in the West Indies in connexion with the manurial requirements of the cacao tree (1).

Preliminary Experimental Work.

A preliminary series of experiments was carried out to determine the extent of the variation of this ratio in respect of development of leaflet and, therefore, the best stage for analysis.

For this purpose two good-yielding and two poor-yielding palms growing on the hillside in the Kuala Lumpur Experimental Plantation were selected. The palms were approximately 15 years old. Five fronds in varying stages of development were taken from each palm. The stages of development may be described as follows:—

(a) Frond newly emerged, leaflets beginning to open.
(b) Frond slightly more developed, all leaflets open.
(c) Frond more developed.
(d) Frond fully developed.
(e) Lowest frond on palm, below fruit bunch ready for harvesting.

The fronds were brought to the laboratory and leaflets removed at regular intervals, *e.g.* every fifth leaflet, along the individual fronds. The leaflets were cut into small pieces and samples drawn for analysis.

In addition to nitrogen and potash, phosphoric acid determinations were made to ascertain whether this constituent varied to any considerable extent as the frond developed. Table I shows the results calculated on a moisture-free basis.

Although, as expected, the figures for individual palms differ widely, the results show that the variation in the nitrogen-potash ratio is lowest when the frond has just emerged. Even at this stage there is a wide difference in the individual ratios; reference to Table I will show that in the case of the four samples the maximum ratio is 1:0.957 and the minimum 1:1.655. As far as potash is concerned, the figure in the minimum ratio shows an increase of approximately 73 per cent. on that in the maximum ratio. This difference is, however, small

Table I.

Results of Analysis of Oil Palm Leaflets from Fronds in Varying Stages of Development.

(Moisture-free Basis)

Description of Frond and Leaflet	Good-Yielding Palm				Poor-Yielding Palm			
	Nitrogen N	Phosphoric Acid as P_2O_5	Potash as K_2O	Nitrogen-Potash N : K_2O Ratio	Nitrogen N	Phosphoric Acid as P_2O_5	Potash as K_2O	Nitrogen-Potash Ratio N : K_2O
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Frond newly emerged, leaflets beginning to open	1.500	0.399	1.435	1 :0.957	1.094	0.326	1.454	1 :1.329
	1.277	0.360	1.641	1 :1.285	1.173	0.389	1.941	1 :1.655
Average	1.389	0.380	1.538	1 :1.107	1.134	0.358	1.698	1 :1.497
Frond slightly more developed, all leaflets open	1.597	0.445	1.447	1 :0.906	1.109	0.321	1.548	1 :1.396
	1.566	0.455	1.672	1 :1.068	1.195	0.369	1.999	1 :1.673
Average	1.582	0.450	1.560	1 :0.986	1.152	0.345	1.774	1 :1.540
Frond more developed	2.241	0.445	1.187	1 :0.530	1.209	0.350	1.682	1 :1.392
	1.894	0.423	1.658	1 :0.875	1.378	0.421	2.027	1 :1.471
Average	2.068	0.434	1.423	1 :0.688	1.294	0.386	1.805	1 :1.395
Frond fully developed	2.064	0.345	0.435	1 :0.211	1.304	0.226	0.461	1 :0.353
	1.211	0.299	0.684	1 :0.565	1.510	0.254	0.593	1 :0.393
Average	1.638	0.322	0.560	1 :0.342	1.407	0.240	0.527	1 :0.375
Lowest frond on palm, below fruit bunch ready for havesting	1.733	0.343	0.393	1 :0.227	0.816	0.134	0.250	1 :0.306
	1.420	0.233	0.207	1 :0.146	1.044	0.174	0.473	1 :0.453
Average	1.577	0.288	0.300	1 :0.190	0.930	0.154	0.362	1 :0.389

compared with that for leaves from below the fruit bunches ready for harvesting. In this case the maximum ratio is 1:0.146, the minimum 1:0.453, and the increase is about 210 per cent.

Experiments with Palms under Varying Manurial Treatments.

A randomized block of palms was used. There were eight replications, each of 10 palms. There were four different treatments, including control, as follows:

Manurial Treatment	Annual Rate of Application of Manure lbs. per palm
Rock phosphate ...	4
Sulphate of potash ...	3
Sulphate of ammonia ...	2
Rock phosphate ...	4
Sulphate of potash ...	3
Rock phosphate ...	4
Control	

The palms were approximately 9 years old, and manures had not been applied for about one year before taking the samples. The area is flat, and the soil may be described as a granite clay loam.

Based on the results of the preliminary work, arrangements were made to select on a given date one frond from each of 5 palms in each of the eight replications of a particular treatment. Five palms were chosen, since observations had shown that this was the maximum number on which fronds in the correct stage of development could be found at a given time. The fronds from each replication were kept separate for the purpose of analysis. The leaflets in each bundle of 5 fronds were sampled as previously described. Table II gives a summary of the results of analysis.

Statistical Examination of the Results.

A statistical examination of the figures was made to ascertain the significant differences for (a) the potash contents for the five treatments (taking the two phosphoric acid treatments separately) and (b) the nitrogen-potash ratios for the same treatments.

The results of the examination may be summarized as follows:

(*a*) *Potash Content.*

Significant difference (P = 0.05) between any two treatments 0.373 per cent.

Significant difference (P = 0.10) between any treatment and control 0.270 per cent.

Table II.

Results of Analysis of Leaflets from Oil Palms under Varying Manurial Treatments.

(Moisture-free Basis)

Constituent	Manurial Treatment	Maximum	Minimum	Average
		per cent.	per cent.	per cent.
Nitrogen	Phosphoric acid, potash ...	1.821	1.589	1.717
	Nitrogen, phosphoric acid, potash ...	1.827	1.621	1.723
	Phosphoric acid ...	1.990	1.704	1.816
	do. ...	1.920	1.674	1.835
	Control ...	1.931	1.635	1.830
Phosphoric acid as P_2O_5	Phosphoric acid, potash ...	0.489	0.416	0.457
	Nitrogen, phosphoric acid, potash ...	0.504	0.438	0.475
	Phosphoric acid ...	0.579	0.471	0.519
	do. ...	0.572	0.462	0.498
	Control ...	0.528	0.446	0.474
Potash as K_2O	Phosphoric acid, potash ...	1.608	1.276	1.402
	Nitrogen, phosphoric acid, potash ...	1.711	1.404	1.509
	Phosphoric acid ...	1.723	1.127	1.357
	do. ...	1.385	1.230	1.326
	Control ...	1.721	1.204	1.388
Nitrogen-Potash Ratio (N: K_2O)	Phosphoric acid, potash ...	1 :0.963	1 :0.701	1 :0.818
	Nitrogen, phosphoric acid, potash ...	1 :0.955	1 :0.768	1 :0.877
	Phosphoric acid ...	1 :0.903	1 :0.566	1 :0.749
	do. ...	1 :0.793	1 :0.622	1 :0.725
	Control ...	1 :0.937	1 :0.644	1 :0.760

There is therefore no significant difference in this respect.

(b) *Nitrogen-Potash Ratio.*

Significant difference (P = 0.05) between any two treatments 0.169 per cent.

Significant difference (P = 0.10) between any treatment and control 0.141 per cent.

There is, therefore, also no significant difference in this respect, the nearest approach thereto being P=0.30 or 30 chances in 100 that the results are fortuitous, a figure which it will be agreed is outside the range of significance.

Summary.

The results of the investigation show that the determination of the nitrogen-potash ratio of the leaflets does not provide any useful information as regards anticipating the manurial requirements of the oil palm.

Acknowledgments.

In conclusion, the writers wish to acknowledge the co-operation of the Manager, Chemara Plantations Ltd. Layang Layang, Johore, in providing the requisite material, also the assistance of Mr. Gunn Lay Teik, Assistant Analyst, in supervising the analytical work.

Reference.

1. McDonald J. A. A Study of the Relationship between Nutrient Supply and the Chemical Composition of the Cacao Tree. Third Annual Report on Cacao Research. Imperial College of Tropical Agriculture, Trinidad, 1933, p. 50.

Received for publication 19th February, 1937.

Abstract.

PROSPECTS OF COCONUT PRODUCTS IN 1937.*

At the end of the year, the world outlook seems distinctly favourable for prices of fats and oils; in the United States, the fact that after purchasing only slightly less copra and coconut oil in the Philippines throughout the year than in 1935, consumers there should be so hard pressed for ready deliveries as to be willing to pay substantial premiums over the current price for spot delivery, seems to indicate quite clearly that consumption in the United States has increased beyond all expectations. If one takes into consideration that the U.S. Government has been spending liberally huge amounts of money on relief, on reforestation, soil conservation, public works, armaments; that it has paid a cash bonus to all veterans; that dividends declared during December by corporations in the United States amount to approximately $800,000,000; that all industries have seen a revival of trade to levels not seen since 1929, it is no surprise to see that the consumption of fats and oils has risen. In Europe, the situation is somewhat similar even if it is not so clear on account of the complexity of political issues, but there seems to be no doubt that many of the European countries which have been suffering from the depression most, are now back on the road to recovery; exchange restrictions are being gradually loosened; collaboration for reciprocal trade agreements and the lowering of tariff walls is being seriously considered, in many, if not in all countries; the steadily rising purchasing power of the Russian masses and the consequent increase in consumption of her own materials by Russia will tend to decrease the surpluses which she has available for export; the prohibition of exports of olive oil from Spain, said to have been decreed by Gen. Franco, withdraws from world markets about 200,000 tons of a very highly prized table oil and is going to be felt sharply in many countries where popular taste prefers this oil for cooking to any other vegetable or animal fat. The whale catch which is now in progress will most likely not produce larger results than in former years, and the fact that practically the whole 1937 crop of Sumatran and Malayan palm oil is already sold is indicative of the intention on the part of European and American soap manufacturers to assure themselves a steady supply of this staple ingredient for soap, at prices which are actually way below the present market values. Last but not least, indications are that the copra crop in the Philippines will be short of normal, at least during the first six months, and estimates of the probable shortage during this period run between 70,000 and 90,000 tons; whether this shortage will be made up by a corresponding increase in the production during the second half of the year is rather doubtful.

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* The following is an abstract of part of an introductory section of a "Review of Coconut Products for 1936", published by Leo Schnurmacher, Inc., brokers of Manila, Philippine Islands. While we refrain from comment on the opinions expressed, we believe that a Philippine view-point will be of interest to readers of this Journal.—*Ed. M.A.J.*

Thus, the situation leaves little doubt that present price levels are not exaggerated, and it must be considered that while at the beginning of the depression the drop in agricultural prices reduced the purchasing powers of farmers and produced a shrinkage of sales of industrial products, thus in turn lowering the purchasing power and consumptive capacity of industrial labour—a vicious circle which resulted in dwindling inter-changes of commodities and services—now, the increase in values of agricultural products and the rise in the consumptive capacity of the farmers act in the reverse direction; they increase employment in the industries, and thus provide a stimulus to the demand for agricultural products which in turn must rise in price. Much could be said about the part invisible stocks play in the interplay of economic factors; it is evident that in a period of dwindling consumer demand and declining values retail stores will be careful buyers and lay in much lower stocks, tending rather to run out of an article than have a few units on the shelves which may take a long time to get cleared out; while in a period of expanding trade, increasing purchasing power and rising values, the tendency is in the opposite direction. There is no doubt that stores practically all over the world must keep larger stocks of practically all articles they carry in order to keep pace with the increased consumer demand, and wholesale demand must be stimulated accordingly.

Another stimulus to demand is speculation, which always sets in when upward movements become a rule rather than an exception; but there is palpable danger that such speculative demand may drive values beyond the proportion which would limit the range of prices growing out of consumptive demand only; and the inherent character of this speculative demand bears the seed of the reaction, as when prices have risen sufficiently, speculators invariably take their profit and produce a setback in prices which may be accentuated by the reluctance of consumers to operate in the market where, due to the speculative demand, they had been forced to pay excessive prices on the rise; and the result is a zigzagging market which, however, generally rises higher after each drop than it had been before.

It is quite likely that this typical picture of a boom arising from fundamental causes will be the picture of the fats and oils market, and in particular, of the coconut oil market, during the first half of 1937, as all indications seem to point that way at present. Whether the second half of the year, with increasing copra supplies in practically all producing countries, will continue to bring rising prices, is a doubtful issue, and must be left unanswered for the present. Too many factors influence the markets and a great many of them are as yet uncertain.

Reviews.

Vegetative Propagation of Tropical and Sub-Tropical Fruits.

By G. St. Clair Feilden and R. J. Garner. Technical Communication, Imperial Bureau of Fruit Production, East Malling, Kent, England, 7, 1936, pp. 67, bibliography, 123, price 2 shillings.

This memoir issued by the Imperial Bureau of Fruit Production on the vegetative propagation of tropical and sub-tropical fruits and other economic plants, forms a standard work of reference for horticultural workers in tropical countries. With the exception of citrus, which was dealt with by the Bureau in a special publication in 1932, all important fruits are included.

It contains references to the various methods of propagation adopted by many investigators in the tropics, compiled from available literature and direct enquiry. An attempt is made to emphasize the successful methods employed in the country where the particular fruit or crop is of importance.

The memoir is divided into two sections. In the first the various methods of vegetative propagation are described concisely, supplemented with line drawings illustrating the technique employed.

The second part describes in some detail the different methods of propagation that have been tried and records the success obtained. Since such information is scattered throughout numerous publications, its compilation in the present form saves much time and trouble to those concerned with the fruits dealt with.

An extensive bibliography and index of common and scientific names is appended, the former affording reference to the more important publications on the subject.

This publication will be of considerable use to Agricultural Officers and others in Malaya who wish to obtain recent information on vegetative propagation of fruit trees. The Department of Agriculture, both at the Central Experiment Station, Serdang, and at Agricultural Stations, has been intimately concerned with such work during the past few years. The information contained in this memoir supplements the experience thus gained and is valuable when investigating the propagation of other fruits. The work of improvement of tropical fruits is as yet in its infancy and a wide scope of work lies ahead; the memoir under review, is particularly welcome as drawing attention to this fact.

J. N. M.

Manures and Manuring.

Bulletin No. 36 of the Ministry of Agriculture and Fisheries. Published by H.M. Stationery Office, Adastral House, Kingsway, London, W.C. 2. 7th edition 1937. 104 pp. Price 2 shillings net.

A book dealing with manures and manuring, intended for the farmer in the United Kingdom, must of necessity be of limited interest to the tropical agriculturist. The present publication is no exception to this rule for it devotes many pages to the application of particular manures to temperate-climate crops. On the other hand, it contains concise information on organic and artificial manures which would enable the planter in the tropics, as well as the farmer in the temperate zones, to derive the fullest advantage from the money spent on manuring.

Following a brief account of the general principles of manuring, the work deals with organic manures, followed by a section on artificial fertilizers. The final part discusses the purchase of artificial manures and their valuation, the manuring of farm crops, and soil analysis.

The perusal of this book should enable the reader to approach with a wider knowledge the subject of manuring and the fertilizers available, with an intelligent appreciation of their valuation, their application, and their limitations.

Manures and Manuring was first published in 1922. In successive editions it has undergone careful revision and in the present edition—the seventh—the subject matter has been brought thoroughly up to-date.

As is usual with publications from this official source, its price brings it within reach of all.

D. H. G.

Dairy Produce.

Compiled by the Intelligence Branch of the Imperial Economic Committee. Published by H.M. Stationery Office, London, W.C. 2. 1936. 66 pp. Price 2s. 8d. post free.

A summary of figures of production and trade relating to butter, cheese, preserved milk, eggs and egg products appeals more to economists and administrators than to the practical farmer or planter. The reviewer's attention was drawn to this report to study the Malayan position in relation to these products.

It appears that Malayan demands for butter, cheese and egg products are negligible, but that this country is the second largest importer in the world of preserved milk, being only exceeded by the United Kingdom. In the latter country, 69 per cent. of the import of condensed milk is in the form of sweetened skimmed milk—an interesting fact in view of modern ideas on the subject of nutrition. In addition Malaya is the ninth largest importer of eggs in the world, and the second largest importer of this product in the British Empire.

Attention has previously been drawn to this interesting series of publications compiled by the Imperial Economic Committee. In this connexion Dairy Produce Supplies 1935 and Weekly Dairy Produce Notes will be found to amplify the information given in Dairy Produce.

Mr. Clauson, Head of the Economic Department in the Colonial Office, in a recent address, pointed out that Colonial economic statistics may assist in the promotion of the economic interests of the Colonial Empire itself, for which purpose it is necessary to know the relative importance of various commodities exported from the Colonial Empire, the markets in which they are sold, the extent to which individual Dependencies are dependent on the export of individual commodities, and something of the production and competitive position of other countries.

The book under review is a typical example of the results of studies such as Mr. Clauson describes, and is a valuable addition to our reference book-shelf.

D. H. G.

Departmental.

FROM THE DISTRICTS.

Compiled by the Chief Field Officer from Monthly Reports of Agricultural Officers.

March, 1937.

The Weather.

Throughout the country the weather was exceptionally hot during the month. In many inland areas in the west of the main range heavy local thunderstorms occurred which tended to increase in frequency towards the end of the month. Except for a few centres as, for example, Tapah, Tampin and Segamat, the rainfall was generally below average in the inland areas west of the main range and was much below average on the west coast. On the east of the main range precipitation was generally below normal inland and was very much below normal on the coast of Pahang and Kelantan. It was hot and dry in Labuan and Brunei.

Remarks on Crops.

Padi.—Harvesting is now over or nearing completion in the main padi areas of the country, which enables a general forecast of the crop to be given.

In Kedah, yields are expected to be below average in the north, in Kuala Muda District and Langkawi, better in Kulim District and good in Baling District.

In the Settlement of Penang the crop is likely to be average or a little below, yields in Penang Island and in the Sungei Acheh area being below normal.

In Perak, it is anticipated that the crop in Krian will be slightly below average, yields in the coastal zone and in the south-east of the District having been low. Good yields are expected in Kuala Kangsar District but the crop in Upper Perak is likely to be below average. In the Sungei Manik area good yields were obtained on the old portion of Stage I and on such of the more recently opened areas that received adequate attention to clearing and preparation of land, were planted up to the scheduled time, and received care during the growth of the crop. The greater part of Stage I, however, still contains much timber and consequently rat damage was severe, more especially on lots owned by cultivators who reside outside the area and gave the crop little or no attention between planting and harvest.

In Selangor, harvesting commenced at Panchang Bedena, and a fairly good crop is expected where rat damage has not been severe. At Tanjong Karang only a poor crop was reaped at both the 12th and 23rd mile areas, rat damage having been very heavy.

The crop in Negri Sembilan is expected to be above that of last season, except in the Seremban District where heavy rain at flowering caused much lodging and in Kuala Pilah District, where there was great variation in the time of planting.

The Malacca crop was reaped under good weather conditions and is expected to be good whilst satisfactory yields generally in Pahang are anticipated.

Kelantan yields of both wet and dry padi will be below those of last season.

A fair crop is expected in Labuan but in Brunei heavy January rains caused much lodging.

Rubber.—There was a sharp rise in price at the end of the month, up to around $53.50 a picul being quoted for smoked sheet in most areas, but as much as $56 a picul is recorded for Central Province Wellesley.

An increased demand for scrap rubber is reported from Perak and Negri Sembilan at prices ranging from $40 to $46 a picul when covered by coupons.

In Selangor, the prices of coupons dropped but, as the result of the strike of Chinese tappers, there was a brisk demand by dealers for rubber to fill contracts or uncovered export rights before the end of the restriction quarter. On the other hand, there was a good demand for coupons in Perak, Pahang and Johore at prices ranging from $30 to $32 in Johore for coupons to cover a picul, and up to $35 in Perak and Pahang. The prices quoted for uncouponed rubber ranged between $12 and $18 a picul in Negri Sembilan and Pahang and from $15 to $25 in various parts of Johore.

In Brunei a further 17 smoke cabinets were erected making a total of 60 now working. A premium of as much as $10 a picul is paid for smoked over unsmoked rubber. The price of native rubber in Brunei ranged between $42 and $48 a picul.

Coconuts.—There was an upward tendency towards the end of the month in the price of copra, Penang quotations varying from $8.30 to $9 a picul. The price of nuts in copra producing areas varied from $25 to $35 per thousand.

Reports regarding the working of drying cabinets indicate that overloading is a frequent fault that militates against the production of good quality copra. The Selangor report states that in that State Malay owners of these cabinets seldom show any desire to produce first class copra and many Malay kiln owners elected to sell their nuts at prices ranging from $2.85 to $3.50 a hundred instead of making copra.

Agricultural Stations and Test Plots.

Agricultural Stations.—The continued dry weather has resulted in the death of a number of pepper, nutmeg, clove and pulasan plants at Gaja Mati Station in Kedah and similar difficulties were reported regarding Raub Station in Pahang and Kilanas Station in Brunei.

At Kuala Kangsar Station in Perak the Villa Franca lemon has produced heavy crops of good fruits and the Valencia Late orange is producing the first crop of fruit.

At Cheras in Selangor, the stocking of the Station with poultry was completed with 153 day-old chicks of three strains supplied from the School of Agriculture Malaya. The chicks are doing well, but the body weight figures are running slightly below the average at the School.

At Rembau Station in Negri Sembilan, holing for an extension of the fruit area was done and two additional poultry houses erected.

At Sungei Udang Station in Malacca, more attention has been given than elsewhere to propagation of fruit trees by inarching. During the month further inarchings of Rambutan No. 4 and Durian "Dato Nena" were made.

In Kelantan, a comprehensive planting and manuring programme was drawn up for the Kota Bahru Station and a lay-out plan prepared for the Bachok Station and work was commenced on paths, drains and the demarcation of blocks. Steps were also taken to bring the poultry work at these Stations in line with the recent circular issued for general guidance.

In Johore, further progress was made in planting the Pineapple Station and the erection of store, plant house and office. The Crotalaria planted is reported to be very effective in minimizing soil erosion. Satisfactory progress was made in the fencing and erection of pens for poultry at Tangkak, Ayer Hitam and Tenglu Stations.

Padi Stations and Plots.—Most of the reports on last season's experiments have been received at Headquarters for statistical examination.

DEPARTMENTAL NOTES.

Meeting of the Agricultural Advisory Committee.

A meeting of the Agricultural Advisory Committee was held at the Department of Agriculture, Kuala Lumpur, on 10th March, 1937, under the chairmanship of the Hon'ble the Adviser on Agriculture (Mr. O. T. Faulkner, C.M.G.).

The meeting reviewed the progress and discussed the programme of research and extensional work of the Department in relation to a wide range of crops. The following are some of the salient points drawn from the minutes of the meeting.

Coconut Industry.—In view of the attitude of the proprietor's section of the United Planters' Association of Malaya and as a result of discussions with Agency houses in London, it was decided that it was useless to attempt to bring into operation a Malayan Mark Scheme for copra.

A scheme in connexion with the experimental local marketing of first-grade copra from small holdings was discussed. The experiment is designed primarily to shew that buyers can obtain first-quality copra from small-holders. The meeting agreed to a proposal that such a scheme be submitted for the approval of the Government.

Pineapple Industry.—Arrangements for future research work were noted. The Chairman stated that it was hoped shortly to recommend to the Governments rules for an enactment regarding standardization of can sizes. Completion of the Pineapple Grading Scheme was postponed pending a decision regarding standard can sizes. In reply to an enquiry the Chairman stated that research on the canning of pineapple juice was included in the programme of work of the Canning Officer. He reported that one factory was now producing canned pineapple juice and the Canning Officer had indicated methods for improving this product which had been adopted.

Among other matters discussed were:—visits of the Canning Officer to other countries, duty on Malayan pineapples imported into Canada, supply and demand of fresh fruit, and new markets for canned pineapples.

Tea.—The prices obtained by the sale of Malayan tea in London were examined by the Committee.

The operation of the Tea Control Enactment was discussed. The Chairman stated that Malaya has been allowed to plant up to a maximum of an additional 3,000 acres of tea before the 31st March, 1938, when the present tea control period will end. Applications for tea planting have been received and the necessary licences issued.

The question of prices of local tea in comparison with those of imported blends was discussed.

Fruit and Vegetable Station, Cameron Highlands.—The Chairman stated that in his opinion the projected fruit and vegetable Station for Cameron Highlands should be established on a larger scale than was at first contemplated. He considered that an area of 20 to 25 acres would be needed eventually with at least

a good Asiatic assistant in charge. The Committee agreed that proposals on these lines should be put up to Government and that the Station should be regarded as being for experimental purposes only with the object of imparting instructions to growers in the locality to enable them to sell fruit and vegetables profitably in the large towns of Malaya. The produce from the Station would be sold, but the objects of the farm must be experimentation and demonstration, not the direct provision of fruit and vegetables to any particular market.

The question of pig keeping and manuring was discussed.

Other Subjects of Discussion.—Other subjects of discussion related to Senior Staff and distribution of duties, rent on sago land, reports of Field and Research Branches, control of the Dairy Farm, Fraser's Hill, investigations concerning derris (tuba root), and Department exhibits at the forthcoming Malayan Exhibition.

MALAYAN TEA IN 1936.

The total estate area planted with tea in Malaya at the end of 1936 was 2,917 acres, 444 acres having been planted during the year under review. Of the total area, 1,440 acres are upland estates and 1,477 acres lowland estates.

The production of made tea during the year was 944,766 lbs. (327,796 lbs. upland, 616,970 lbs. lowland). Exports of tea amounted to 650,382 lbs., and local sales to 289,950 lbs.

The net imports of tea amounted to 3,894,593 lbs. Local consumption was thus 4,184,543 lbs., or approximately 1 lb. per head of population.

Statistical.

MARKET PRICES.

March, 1937.

Major Crops.

Rubber.—The month was notable for another sharp and considerable rise in this market. Spot loose opened in Singapore at 36½ cents per lb., and rose steadily to 42½ cents by the 19th March; it weakened slightly subsequently, but rose to 43¼ cents on the 25th, and again to 45¼ cents on the 30th after the Easter holidays, closing at 45⅜ cents.

The average price for the month of No. 1 X. Rubber Smoked Sheet was 39.80 cents per lb. as compared with 35.89 cents in February. The London average price was 11.64 pence per lb., and the New York price 23.65 cents gold, as compared with 10.48 pence and 21.21 cents gold in the previous month.

Prices paid for small-holders' rubber at three centres during the month are shewn in Table I.

Table I.

Weekly Prices Paid By Local Dealers for Small-Holders' Rubber, March, 1937.

(Dollars per Picul.)

Grades.	Kuala Pilah, Negri Sembilan.				Kuala Kangsar, Perak.			Batu Pahat, Johore.				
	4	11	18	25	3	10	17	3	10	17	24	31
Smoked sheet	46.50	48.78			46.00	47.66	49.00	45.00	47.30	50.00	51.29	
Unsmoked sheet		45.42	50.09					43.40	45.50	48.00	49.50	53.50
Scrap			41.00	41.50								

Transport by F.M.S.R. lorry service Kuala Pilah to Seremban 12 cents per picul, to Malacca excluding duty, 25 cents per picul, by rail Seremban to Penang $1.24 per picul, Seremban to Singapore $8.00 per ton.
Transport from Batu Pahat to Singapore by lorry excluding duty, 90 cents per picul.
Transport from Kuala Kangsar to Prai by railway $6.20 per ton.
Transport from Kuala Kangsar to Singapore by railway $10.00 per ton (minimum consignment 5 tons).
At Kuala Pilah the standard deduction for moisture in unsmoked sheet is 5 per cent.
At Kuala Kangsar the standard deduction for moisture in unsmoked sheet is 10 per cent.
No purchases at Kuala Kangsar on the 24th and 31st March.

Palm Oil.—Prices improved again in March and are tabulated below.

Table II.
Prices of Palm Oil and Palm Kernels.

Date 1937.	Palm Oil in Bulk, c i.f. landed weight Liverpool/ Halifax.	Palm Kernels, c.i.f. landed weight London/ Continent
	per ton	per ton
March 5	£ 25. 0. 0	£ 15. 0. 0
„ 12	26. 15. 0	15. 5. 0
„ 19	27. 0. 0	15. 15. 0
„ 25	27. 0. 0	15. 15. 0

Copra.—The Singapore market shewed a steady improvement with slight weakening in the middle and again towards the end of the month. The sun-dried grade opened in Singapore at $7.85 per picul, reaching $8.55 on the 11th March, and, after slight weakening, $8.50 on the 18th; it weakened again, but improved to close at $8.30, with an average price for the month of $8.25 per picul as against $7.92 in February. The mixed grade averaged $7.96 per picul as compared with $7.65 in the previous month.

Copra cake remained unchanged at $2.25 per picul.

Rice.—The average wholesale prices of rice per picul in February were as follows:—Siam No. 2 (ordinary) $4.66, Rangoon No. 1 $3.67, Saigon No. 1 $4.02, as compared with $4.95, $3.67 and $4.50 in February. The corresponding February 1936 prices were $3.81, $3.35 and $3.35.

The average retail prices in cents per gantang of No. 2 Siam rice in February were: Singapore 32, Penang 36, Malacca 33, as compared with 32, 37 and 35 respectively in January.

The average declared trade value of imports of rice in February was $4.15 per picul, as compared with $4.00 in January, and $3.74 in December 1936.

Padi.—The Government Rice Mills, Perak, continued to pay $2 per picul for padi in March. Retail prices ranged from 6 to 14 cents per gantang.

Pineapples.—Prices weakened still further during March, closing, for G.A.Q., at (per case): Cubes $3.05, Sliced Flat $2.90, Sliced Tall $3.10. The corresponding prices for the Golden quality were $3.35, $3.25 and $3.40 per case.

Prices of fresh fruit per 100 were: Selangor $1.50 to $2.00; Singapore $1.80 to $1.90; Johore 1st quality $1.40 to $2.40, 2nd quality $1.20 to $1.70, 3rd quality 80 cents to $1.20.

Beverages.

Tea.—Four consignments of Malayan tea were sold on the London market during March, one being upland tea, which averaged 1s. 2½d. per lb. The lowland tea sold at 1s. 1¾d. per lb.

Average London prices per lb. during February for consignments of tea from other countries were as follows:—Ceylon 1s. 4.98d., Java 1s. 1.66d., Indian Northern 1s. 2.44d., Indian Southern 1s. 3.16d., Sumatra 1s. 0.29d.

The latest Colombo average prices available, quoted from the *Weekly Tea Market Report*, 23rd March, 1937, of the Colombo Brokers' Association are as follows, in rupee cents per lb.:—High Grown Teas 87 cents, Medium Grown Teas 77 cents, Low Grown Teas 72 cents.

Coffee.—The Singapore market improved during March. Sourabaya coffee averaged $16.19 to $17.19 per picul, and Palembang $13.06 to $14.06, as compared with $14.62 to $17.62 and $10.69 to $11.81 respectively in February.

Spices.

Arecanuts.—The range of average prices per picul in Singapore during March was as follows: Splits $5.44 to $6.44, Red Whole $5.50 to $7.76, Sliced $13.38 to $15.38.

The averages of the Singapore Chamber of Commerce quotations per picul were: Best $7.31, Medium $6.56, Mixed $6.31.

Pepper.—There was a slightly better tone in this market during March, but the weight of London stocks prevents values rising in sympathy with those of other commodities. Average prices per picul were: Singapore Black $10.88, Singapore White $18.81, Muntok White $19.31.

Nutmegs.—Quotations continued unchanged at $30 per picul for both 110's and 80's.

Mace.—This market also remained unchanged: Siouw $100 and Amboina $80 per picul.

Cloves.—Nominal quotations for both Zanzibar and Amboina remained at $40 per picul.

Cardamoms.—Green cardamoms were quoted in the Ceylon Chamber of Commerce reports at Rs. 2.28 to Rs. 2.45 per lb., closing at Rs. 2.25 to Rs. 2.50 per lb.

Miscellaneous.

Derris (Tuba Root).—The Singapore market was dull during March with lack of buying enquiry from the bigger buyers in Europe and America. Prices remained unchanged, and were: $49 per picul for roots sold on rotenone content; $32 per picul for roots sold on a basis of ether extract.

Gambier.—Block improved to average $7.75 per picul, and No. 1 Cube to average $15.50, as compared with $7 and $15 respectively in February.

Tapioca.—Prices remained unchanged throughout the month at: Flake Fair $5.50, Seed Pearl $6, Medium Pearl $6.50.

Sago.—Pearl, Small Fair, improved to $5.50 per picul, but Flour, Sarawak Fair, weakened at the close, averaging $4.06. The February average prices were $5.25 and $3.88 respectively.

Tobacco.—The general range of prices per picul was as follows:—1st quality $20 to $55, 2nd quality $15 to $35, 3rd quality $10 to $25. In Kelantan the range was $90 to $100, $80, $65 to $72.

The above prices are based on London and Singapore daily quotations for rubber; on the Singapore Chamber of Commerce Weekly Reports for the month and on other local sources of information. Palm oil reports are kindly supplied by Messrs. Guthrie & Co. Ltd., Kuala Lumpur; the Singapore prices for coffee and arecanuts by the Lianqui Trading Company of Singapore, and tuba prices by Messrs. Kohyei & Co., Singapore.

1 picul = 133⅓ lbs. The Dollar is fixed at two shillings and four pence.

Note.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural produce. Similar assistance is also offered by the Malayan Information Agency, 57 Trafalgar Square, London, W.C. 2.

GENERAL RICE SUMMARY*

February, 1937.

Malaya.—Imports of foreign rice during February were 59,172 tons,† and exports 7,942 tons, net imports being 51,230 tons as compared with 49,710 tons in 1936.¶

Of the imports during February, 55 per cent. were consigned to Singapore, 15 per cent. to Penang, 8 per cent. to Malacca, 20 per cent. to the Federated Malay States, and 2 per cent. to the Unfederated Malay States. The imports by countries of origin were as follows (in tons, percentages in brackets):—Siam 32,467 (54.9), Burma 23,747 (40.1), French Indo-China 1,879 (3.2), other countries 1,079 (1.8).

Of the exports during February, 60 per cent. were consigned to the Netherlands Indies, and 40 per cent. to other countries. The various kinds of rice exported were as follows (in tons, percentages in brackets):—Siam 6,280 (79.1), Burma 1,209 (15.2), French Indo-China 341 (4.3), parboiled 72 (0.9), local production 40 (0.5).

India and Burma.—Foreign exports during January were 114,000 tons, an increase of 48.1 per cent. when compared with 77,000 tons in 1936. Of these, 2.6 per cent. were to the United Kingdom, 2.6 per cent. to the Continent of Europe, 47.4 per cent. to Ceylon, 30.7 per cent. to the Straits Settlements and the Far East, and 16.7 per cent. to other countries. The corresponding percentages in 1936 were 2.6, 1.3, 58.4, 26.0 and 11.7.

According to the *Bangkok Times*, 8th March, 1937, estimates indicate that the sown rice area in Burma has been extended, and there are prospects of this area maturing: it is thus reasonable to expect an increase of Burma rice on the market.

Siam.—Exports of rice and rice products from Bangkok during December were 79,780 tons, the total for 1936 being 1,583,165 tons as compared with 1,524,326 tons in 1935.

Japan.—Japan's actual rice crop for 1936 (*Trans-Pacific Journal*, 4th February 1937) amounted to 9,444,982 tons, an increase of 1,386,396 tons or 17.2 per cent. over the 1935 actual crop, and 1,149,565 tons or 13.9 per cent. over the average for the previous five years. The total plantation acreage for the year was 7,857,108 acres.

The yield of the second Formosan rice crop of 1936 was 675,971 tons, an increase of 3,635 (0.54 per cent.) over the actual yield of the previous year. The acreage planted was 938,805 acres, a decrease of 4,885 acres, which means that the yield per acre has risen 1.06 per cent. The combined first and second Formosan crops have increased from 908,893 tons in 1929 to 1,340,530 tons in 1936, in spite of the efforts of the authorities to encourage substitute crops.

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* Abridged from the Rice Summary for February, 1937, compiled by the Department of Statistics, Straits Settlements and Federated Malay States.

† Ton = long ton (2,240 lbs.)

¶ It is to be understood throughout the summary that all comparisons and percentage increases or decreases are in relation to the corresponding period of 1935 or 1936.

French Indo-China.—Entries of padi into Cholon during January and February totalled 268,131 tons, as compared with 313,727 tons in 1936, a decrease of 14.5 per cent. Exports of rice in the same period were 200,619 tons, a decrease of 8.5 per cent. when compared with 219,223 tons in 1936.

The Netherlands Indies.—The latest information available was published in the January Summary.

Ceylon.—Imports during January and February totalled 97,586 tons, a decrease of 2.9 per cent. when compared with the 1936 figure of 100,543 tons. Of these imports 16.6 per cent. were from British India, 71.8 per cent. from Burma, 0.3 per cent. from the Straits Settlements, and 11.3 per cent. from other countries. The corresponding percentages for 1936 were 8.8, 64.3, nil, and 26.9.

Europe and America.—Shipments from the East to Europe during the period 1st January to 4th February totalled 16,044 tons, as compared with 7,270 tons in 1936, an increase of 120.7 per cent. Of these shipments 33.7 per cent. were from Burma, 49.8 per cent. from Siam, and 16.5 per cent. from Bengal. The 1936 percentages were 69.2, 23.2, and 7.6 respectively.

Shipments for the Levant from the 1st to the 28th January were 124 tons, as compared with 1,035 tons in 1936. Shipments to Cuba, West Indies and America from the 1st to the 23rd January were 5,230 tons as compared with 7,269 tons in 1936, a decrease of 28 per cent.

MALAYAN AGRICULTURAL EXPORTS, JANUARY, 1937.

PRODUCT.	Net Exports in Tons		
	Year 1936	January 1936	January 1937
Arecanuts ...	26,548	3,165	4,087
Coconuts, fresh † ...	114,314†	9,629†	4,939†
Coconut oil ...	46,507	3,130	2,579
Copra ...	76,681	7,292	4,275
Gambier, all kinds ...	2,188	200	126
Copra cake § ...	20,438§	1,342§	1,097§
Palm kernels ...	4,964	402	594
Palm oil ...	29,296	1,610	1,822
Pineapples canned ...	76,403	6,788	6,316
Rubber ¶ ...	365,005¶	33,329¶	39,909¶
Sago,—flour ...	6,180	339	1,812
,, —pearl ...	3,319	277	314
,, —raw ...	7,484*	960*	591*
Tapioca,—flake ...	1,535	165	143
,, —flour ...	2,418*	7	23*
,, —pearl ...	17,797	990	1,875
Tuba root ...	599	67	94

† hundreds in number. * net imports. ¶ production. § gross exports.

MALAYAN PRODUCTION OF PALM OIL AND KERNELS

(In long tons, as declared by Estates)

Month 1937	Palm Oil		Palm Kernels	
	F.M.S.	U.M.S.	F.M.S.	U.M.S.
January ...	1,984.8	1,403.9	360.4	232.8
February ...	1,759.6	1,312.9	323.6	231.9
Total ...	3,744.4	2,716.8	684.0	464.7
Total January and February, 1936 ...	2,927.3	698.9	502.8	91.8
Total for the year 1936 ...	23,081.2	8,812.3	3,791.0	1,340.7

MALAYAN RUBBER STATISTICS

ACREAGES OF TAPPABLE RUBBER NOT TAPPED ON ESTATES OF 100 ACRES AND OVER, FOR THE MONTH ENDING 28TH FEBRUARY, 1937.

STATE OR TERRITORY (1)	Estimated Acreages of Tappable Rubber (2)	ESTATES WHICH HAVE ENTIRELY CEASED TAPPING		ESTATES WHICH HAVE PARTLY CEASED TAPPING (*a*)		AREA OF TAPPABLE RUBBER NEVER BEEN TAPPED		Total (3) + (5) (9)	Percentage of (9) to (2) (10)
		Acreage (3)	Percentage of (3) to (2) (4)	Acreage (5)	Percentage of (5) to (2) (6)	Acreage (7)	Percentage of (7) to (2) (8)		
STRAITS SETTLEMENTS :—									
Province Wellesley	43,890	210	.5	18,293	41.7	401	.9	18,503	42.2
Malacca	120,563	663	.6	43,901	36.4	3,072	2.5	44,564	37.0
Penang Island	2,272	675	29.7	615	27.1	106	4.7	1,290	56.8
Singapore Island	32,825	4,587	14.0	9,325	28.4	301	.9	13,912	42.4
Total S.S. ...	199,550	6,135	3.1	72,134	36.1	3,880	1.9	78,269	39.2
FEDERATED MALAY STATES :—									
Perak	294,127	5,830	2.0	89,631	30.5	13,110	4.5	95,461	32.5
Selangor	339,583	7,065	2.1	102,970	30.3	15,624	4.6	110,035	32.4
Negri Sembilan	264,249	4,671	1.8	86,234	32.6	16,234	6.1	90,905	34.4
Pahang	83,557	8,114	9.7	27,672	33.1	17,317	20.7	35,786	42.8
Total F.M.S. ...	981,516	25,680	2.6	306,507	31.2	62,285	6.3	332,187	33.8
UNFEDERATED MALAY STATES :—									
Johore	453,866	25,663	5.7	41,330	9.1	38,619	8.5	66,993	14.8
Kedah	200,179	11,934	6.0	64,729	32.3	14,146	7.1	76,663	38.3
Kelantan	27,782	403	1.4	5,860	21.1	2,820	10.2	6,263	22.5
Trengganu (*b*)	4,817	nil	nil	1,651	34.3	100	2.1	1,651	34.3
Perlis (*c*)	1,280	nil	nil	740	57.8	177	13.8	740	57.8
Brunei	4,645	nil	nil	1,132	24.4	898	19.3	1,132	24.4
Total U.M.S. ...	692,569	38,000	5.5	115,442	16.7	56,760	8.2	153,442	22.2
TOTAL MALAYA ...	1,873,635	69,815	3.7	494,083	26.4	122,925	6.6	563,898	30.1

Notes :—(a) Area out of tapping on estates which have partly ceased tapping refers to areas definitely being rested and includes areas rested under rotational systems, but excludes areas on any tapping round in respect of Perlis only.
(*b*) Registered companies only.
(*c*) Rendered quarterly.

MALAYAN RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF FEBRUARY, 1937, IN DRY TONS.

State or Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month			Consumption 3	
								during the month		January and Feb. 1937		during the month		January and Feb. 1937						
	Ports	Dealers	Estates of 100 acres and over	during the month	January and Feb. 1937	during the month	January and Feb. 1937	Foreign	From Malay States & Labuan	Foreign	From Malay States & Labuan	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over	during the month	January and Feb. 1937
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
MALAY STATES :—																				
Federated Malay States ...	...	8,771	14,409	12,260	25,966	4,744	11,781	Nil	Nil	Nil	Nil	10,654	5,281	23,117	8,611	...	9,977	14,252	20	40
Johore ...	...	2,309	5,046	4,949	10,483	4,292	8,423	Nil	104	Nil	215	2,491	6,452	5,184	13,046	...	2,714	5,043	...	...
Kedah ...	...	496	3,794	2,689	6,143	1,015	2,346	Nil	Nil	Nil	Nil	2,122	1,863	4,218	4,180	...	555	3,454	...	...
Perlis ...	...	13	20	11	28	14	40	Nil	Nil	Nil	Nil	Nil	29	Nil	61	...	12	17	...	...
Kelantan ...	...	352	299	336	704	950	1,645	Nil	Nil	Nil	Nil	200	858	386	1,568	...	567	312	...	...
Trengganu ...	...	55	50	297	480	149	241	Nil	Nil	Nil	Nil	Nil	446	Nil	721	...	55	50	...	...
Brunei ...	...	13	48	63	124	76	161	...	...	...	...	...	129	...	260	...	9	62	...	...
Total Malay States	...	12,009	23,666	20,605	43,928	11,240	24,637	Nil	104	Nil	215	15,467	15,058	32,905	28,447	...	13,889	23,190	20	40
S. SETTLEMENTS :—																				
Malacca ...	...	2,200	1,283	1,217	2,626	671	1,322	Nil		Nil		2,149		5,089		...	2,296	1,168	...	...
Province Wellesley	...	1,834	702	475	1,070	200	417	Nil		Nil		4,700		10,119		...	2,994	578	...	...
Penang ...	1,636	5,681	13	9	25	97	176	3,192	13,155	7,289	27,330		Nil		Nil	2,911	6,498	12	...	...
Singapore ...	6,980	22,068	189	145	306	79	127	10,812		23,613		15,742		31,516		7,514	25,209	201	25	58
Labuan ...	...	15	Nil	Nil	Nil	21	34	44		102		Nil		Nil		...	18	Nil	...	...
Total Straits Settlements ...	8,616	31,798	2,187	1,846	4,027	1,068	2,076	14,048	13,155	31,004	27,330	22,591	Nil	46,724	Nil	10,425	37,015	1,959	25	58
Total Malaya ...	8,616	43,807	25,853	22,451	47,955	12,308	26,713	14,048	13,259	31,004	27,545	38,058	15,058	79,629	28,447	10,425	50,904	25,149	45	98

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings M'cca.	Johore	Kedah
22	23	24	25	26	27	28
DRY RUBBER	8,599	24,094	6,110	5,006	2,210	286
WET RUBBER	1,378	1,115	388	311	504	269
TOTAL ...	9,977	25,209	6,498	5,317	2,714	555

TABLE III
FOREIGN EXPORTS

PORTS 29	For month 30	January and Feb. 1937 31
Singapore ...	25,358	51,790
Penang ...	8,014	17,727
Port Swettenham.	4,487	9,684
Malacca ...	199	428
MALAYA ...	38,058	79,629

TABLE IV
DOMESTIC EXPORTS 4

AREA 32	For month 33	January and Feb. 1937 34
Malay States ...	29,268	59,707
Straits Settlements	2,949	5,648
MALAYA ...	32,217	65,355

Notes:—

1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained.
2. The production of estates of less than 100 acres is estimated from the formula: Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption. *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [20] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements the production of estates of less than 100 acres is represented by sales or exports as shown by cess paid.
3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15% wet sheet, 25% scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.
4. Columns (33) and (34) represent exports of rubber subject to regulation which, for Singapore and Penang Islands are represented by sales or exports as shown by cess paid.
5. All statements are brought up to date monthly, and any inaccuracies that may be disclosed are correeted in the totals; the latest publication, therefore, is always the most reliable.
6. The above, with certain omissions, is the Report published by the Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 30th March, 1937.

METEOROLOGICAL SUMMARY, MALAYA, FEBRUARY, 1937.

Locality.	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine.		
	Means of			Absolute Extremes						Total.		Most in a day.	Number of days.					Total.	Daily Mean.	Per cent.
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet			Amt.	Precipitation .01 in or more	Precipitation .04 in or more	Thunder-storm	Fog morning obs.	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						Hrs.	Hrs.	
Railway Hill, Kuala Lumpur, Selangor ...	92.0	71.8	81.9	95	69	85	74	84.1	84.8	12.25	311.2	3.60	15	13	3	1		211.90	7.57	63
Bukit Jeram, Selangor ...	89.5	72.3	80.9	92	71	87	74	85.0	86.1	2.39	60.7	0.51	12	9	3	1		243.15	8.68	72
Sitiawan, Perak ...	89.8	72.4	81.1	92	69	83	75	84.0	84.2	2.78	70.6	0.97	10	7	1			224.10	8.00	67
Temerloh, Pahang ...	88.6	71.3	79.9	92	67	83	74	84.9	84.8	2.00	50.8	0.67	12	9	2	8		219.55	7.84	65
Kuala Lipis, Pahang ...	88.7	70.7	79.7	93	68	81	73	83.7	84.0	2.75	69.9	1.33	10	7		20		191.65	6.84	57
Kuala Pahang, Pahang ...	84.6	75.7	80.1	86	72	81	79	84.3	84.6	8.47	215.1	2.15	12	11				205.70	7.35	61
Kallang Aerodrome, S'pore ...	86.1	74.8	80.5	90	71	79	77	81.5	82.6	7.54	191.5	2.64	13	13	3		1	170.95	6.11	50
Butterworth, Province Wellesley ...	89.6	72.9	81.3	92	69	85	75	85.7	85.4	4.68	118.9	1.72	9	5	2			260.35	9.30	78
Bayan Lepas Aerodrome Penang ...	89.7	73.5	81.6	93	70	86	76	84.4	84.4	1.51	38.4	0.74	4	3	2			255.25	9.12	77
Bukit China, Malacca ...	88.5	73.7	81.1	92	72	81	75	83.9	84.1	2.96	75.2	1.04	10	9	4		2	216.60	7.73	64
Kluang, Johore ...	86.7	71.9	79.7	92	69	78	74	80.6	81.4	2.34	59.5	0.62	14	11	3	5		178.94	6.39	53
Bukit Lalang, Mersing, Johore	83.0	74.0	78.5	85	67	76	79	80.0	80.0	7.28	184.9	3.54	12	8			1	188.65	6.74	56
Alor Star, Kedah ...	94.0	70.5	82.3	97	66	90	77	88.1	86.5	0.41	10.4	0.38	3	1	1			255.25	9.12	77
Kota Bahru, Kelantan ...	86.5	71.0	78.7	89	65	85	77	81.8	82.9	1.48	37.6	0.95	7	6		2		240.31	8.58	72
Kuala Trengganu, Trengganu	85.3	72.5	78.9	87	68	83	78	81.9	82.5	2.02	51.3	1.20	8	7		4		231.70	8.27	69
HILL STATIONS.																				
Fraser's Hill, Pahang 4268 ft.	72.5	61.3	66.9	79	59	65	64	72.2	72.2	7.42	188.5	2.45	16	11		20		140.85	50.3	42
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	73.3	54.2	63.7	77	41	66	61	69.1	69.4	5.47	138.9	1.63	14	11	1		5	175.50	6.27	52
Cameron Highlands, Rhododendron Hill, Pahang 5120 ft. ...	72.9	57.9	65.4	78	51	65	60			5.86	148.9	2.02	12	11	1		5	186.20	6.65	55

Compiled from Returns supplied by the Meteorological Branch, Malaya.